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Dimension Stone

UNITED STATES DEPARTMENT OF THE INTERIOR

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Dimension Stone

By Harold A. Taylor, Jr.[1]

Production of dimension stone increased slightly to 1.18 million short tons valued at $190 million. More than one-half of the dimension stone produced was granite. Limestone, marble, sandstone, and slate were also produced.

Exports of dimension stone increased 40% in value to $20 million. The value of dimension stone imports for consumption increased 16% to $439 million, equivalent to 231% of the value of domestic production.

Domestic Data Coverage.—Domestic production data for dimension stone are developed by the Bureau of Mines from voluntary surveys of U.S. producers of rough and finished dimension stone. Of the 442 dimension stone operations surveyed, including those that were idle, 415, or 94%, responded, representing 97% of the total value sold or used by producers, as shown in table 1. Production data for nonrespondents were estimated using preliminary production reports, adjusted prior years production levels, and employment data.

Table 1.—Salient U.S. dimension stone statistics

(Thousand short tons and thousand dollars)

	1983	1984	1985	1986	1987
Sold or used by producers[1]	1,090	e1,141	1,104	e1,163	1,184
Value[1]	$147,843	e$161,912	$172,435	e173,269	$190,153
Exports (value)	19,126	$23,067	$13,835	$14,623	$20,470
Imports for consumption (value)	$191,663	$222,596	$291,246	$379,724	$439,278

eEstimated. rRevised.
[1]Excludes Puerto Rico.

DOMESTIC PRODUCTION

In 1987, dimension stone was produced by 185 companies at 271 quarries in 35 States. Leading States, in order of tonnage, were Indiana, Georgia, and Vermont, producing together 39% of the Nation's total. Georgia's output was down 10% from the year before, and Indiana's down 4%. Of the total 1987 production, 52% was granite, 28% was limestone, 10% was sandstone, 3% was slate and 2% was marble. The remaining 5% was miscellaneous stone, including argillite, schist, soapstone, and traprock (basalt). Leading producing companies in terms of tonnage were Cold Spring Granite Co. principally in California, Minnesota, South Dakota, and Texas; Rock of Ages Corp. in New Hampshire and Vermont; and Coggins Granite Industries Inc. in Georgia.

Granite.—Dimension granite includes all coarse-grained igneous rocks. Production increased slightly to 629,000 tons and increased 10% in value to $107 million. Granite was produced by 64 companies at 103 quarries in 22 States. Georgia continued to be the leading State, producing 26% of the U.S. total, followed by Vermont and Massachusetts. These three States together produced more than 51% of the U.S. total. Cold Spring Granite, Rock of Ages Corp., and Coggins Granite Industries were the leading producers and accounted for 31% of U.S. production.

In December, the International Trade Administration, U.S. Department of Commerce, made a preliminary positive countervailing duty determination on granite products from Spain. A number of Spanish manufacturers had received subsidies such as short-term Government loans to exporters, and rebates of interest, grants and preferential access to Government credit under a regional development program to encourage employment in the Province of Galicia. Furthermore, Basque-area authorities provided subsidies through cash grants for making investments in capital goods. This action was preliminarily determined not to be countervailable. Several other subsidy programs were not used and several are still being investigated. Except for two firms with different rates, the net subsidy was determined to be 2.51%. Barring difficulties, the final determination was to be made by March 3, 1988. If the determination is positive, the U.S. International Trade Commission (ITC) will determine whether these imports injure the U.S. industry.

Also in December, the International Trade Administration made a preliminary negative countervailing duty determination on granite products from Italy. This determination of no benefit is based on a net subsidy of zero for almost all responding firms and a de minimis subsidy of 0.36% for all other firms, including those firms that did not respond to requests for information. The countervailable programs identified were a reduction in social security payments for firms in the Mezzogiorno, a regional loan program, and local tax concessions. Although one firm was found to have a de minimis benefit from a local tax concession. Some programs did not confer a subsidy. Those included an accelerated depreciation and tax exemptions for reinvested capital gains. Others, such as a rebate of customs duties, export credit financing, and preferential rates on Italian railroads, were not used. A final negative determination would end the case, but a positive finding would move it to the ITC for an injury determination.

Limestone.—Dimension limestone includes bituminous, dolomitic, and siliceous limestones. It was produced by 38 companies at 45 quarries in 13 States. Indiana, the leading State, was followed by Wisconsin and Texas. Leading producers were Indiana Limestone Co. Inc., Elliott Stone Co. Inc., and Independent Limestone Co. The top three companies accounted for 28% of U.S. output.

Marble.—Dimension marble includes certain hard limestones, travertines, and any other calcareous stones that can be polished. Dimension marble was produced by 7 companies at 10 quarries in 6 States. Georgia, Vermont, and New Mexico, in order of tonnage, were the leading States, accounting for approximately 85% of U.S. output. Leading producers were Georgia Marble Co., Vermont Marble Co., and Rocky Mountain Stone Co. The top three companies accounted for 85% of U.S. output.

Sandstone.—Dimension sandstone includes calcareous- and siliceous-cemented sandstones or conglomerates. Quartzite, which is also included, may be described as siliceous-cemented sandstone. It was produced by 35 companies at 40 quarries in 17 States. Leading States were, in order of volume, Ohio, New York, and Pennsylvania. These three States accounted for almost two-thirds of U.S. output. Delaware Quarries Inc., Waller Bros. Stone Co., and Standard Slag Co. were the leading producers, accounting for 39% of U.S. production. In addition to the quantities shown in table 6, dimension quartzite totaled 19,451 tons worth $1,465,315.

Slate.—Dimension slate was produced by 19 companies at 29 quarries in 5 States. The two leading producing States, in order of volume, Pennsylvania and Vermont, accounted for 75% of U.S. output. The top three producers, A. Dally and Sons Inc., Hilltop Slate Co., and Le Sueur-Richmond Slate Co. Inc., accounted for an estimated 54% of U.S. output by value.

Miscellaneous Stone.—Miscellaneous dimension stone, including traprock, was produced by 10 companies from 10 quarries in 4 States, and totaled 17,961 tons valued at $1,232,624.

Table 2.—Dimension stone sold or used by producers in the United States, by State

State	1986[e]		1987	
	Quantity (short tons)	Value (thousands)	Quantity (short tons)	Value (thousands)
Alabama	7,797	$968	W	W
Arkansas	5,145	305	10,541	$629
California	22,794	2,582	33,335	4,554
Colorado	3,600	255	3,000	133
Connecticut	24,425	1,653	18,140	1,646
Georgia	198,905	20,678	179,207	21,683
Illinois	1,750	107	W	W
Indiana	190,995	20,252	183,609	23,115
Kansas	W	W	11,423	445
Maine	W	W	7,512	5,924
Maryland	20,505	1,286	22,843	1,516
Massachusetts	78,728	14,928	76,579	12,747
Michigan	5,836	148	W	W
Minnesota	27,973	10,507	41,354	12,967
Missouri	W	W	3,212	454
New Hampshire	82,294	6,451	67,479	10,684
New Mexico	21,615	378	21,893	626
New York	15,637	3,002	38,553	5,822
North Carolina	41,418	6,633	32,669	5,128
Ohio	35,698	2,708	47,816	2,427
Oklahoma	18,503	913	8,311	861
Pennsylvania	72,352	8,100	60,118	10,177
South Carolina	7,550	533	2,319	312
South Dakota	54,934	18,399	50,718	18,209
Tennessee	5,598	1,553	3,360	573
Texas	49,457	15,407	75,426	10,030
Utah	W	W	2,004	95
Vermont	104,610	27,075	103,923	30,074
Virginia	9,542	3,128	9,077	2,720
Washington	1,223	69	297	42
Wisconsin	22,912	2,878	36,903	3,697
Other[1]	31,551	2,371	32,228	2,865
Total[2]	1,163,347	[2]173,269	1,183,849	190,153

[e]Estimated. W Withheld to avoid disclosing company proprietary data; included with "Other."
[1]Includes data for Arizona, Idaho, Iowa, Montana, Oregon (1986), and data indicated by symbol W.
[2]Data may not add to totals shown because of independent rounding.

Table 3.—Dimension granite sold or used by producers in the United States, by State

State	1986[e]		1987[p]		
	Quantity (short tons)	Value (thousands)	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
California	15,075	$1,257	16,525	202	$3,410
Connecticut	11,742	826	W	W	W
Georgia	166,504	9,504	166,108	1,652	11,054
Maine	W	W	7,512	91	5,924
Massachusetts	W	W	74,079	866	12,372
New Hampshire	81,647	6,423	67,479	818	10,684
North Carolina	28,813	4,675	28,526	346	4,786
Oklahoma	6,346	762	5,950	70	796
Pennsylvania	9,132	1,898	12,516	149	2,566
South Carolina	8,052	568	2,319	28	312
South Dakota	53,402	18,236	50,718	541	18,209
Texas	W	W	46,717	545	6,935
Vermont	97,267	14,661	83,660	1,012	15,400
Wisconsin	3,253	1,956	2,730	31	2,241
Other[1]	144,009	36,239	64,526	756	12,367
Total[2]	625,242	97,005	629,365	7,106	107,056

[e]Estimated. [p]Preliminary. W Withheld to avoid disclosing company proprietary data; included with "Other."
[1]Includes data for Colorado, Maryland, Minnesota, Missouri, New York, South Carolina, Virginia, Washington, and data indicated by symbol W.
[2]Data may not add to totals shown because of independent rounding.

CONSUMPTION AND USES

Dimension stone was marketed over wide areas. Industry stockpiles were not monitored, and production during 1987 was assumed to equal consumption.

Consumption of domestic dimension stone decreased slightly to 1.18 million tons valued at $190.2 million. Dressed ashlars and partially squared pieces made up 24% of the total value of consumption, followed by dressed monumental, 14%; rough stone used for monumental purposes, 14%; curbing, 12%; rough blocks for building and construction, 10%; and other uses, 26%.

Of the total consumption of domestic granite, 24% by value was of rough monumental, 23% was of ashlars and partially squared pieces, and 22% was curbing.

Consumption of domestic limestone totaled 329,800 tons valued at $35.0 million, of which 33% by value was of ashlars and partially squared pieces and 28% was of rough blocks for building and construction.

Table 4.—Dimension limestone sold or used by producers in the United States in 1987, by State

State	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Indiana	179,809	2,480	$22,890
Kansas	11,423	149	445
Texas	28,707	370	3,095
Wisconsin	31,584	373	1,297
Other[1]	78,318	989	7,240
Total[2]	329,843	4,361	34,968

[1]Includes Alabama, California, Iowa, Minnesota, Montana, New York, Ohio, and Virginia.
[2]Data may not add to totals shown because of independent rounding.

Table 5.—Dimension marble sold or used by producers in the United States in 1987, by State

State	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Massachusetts	2,500	25	$375
Other[1]	21,871	258	20,038
Total	24,371	[2]282	20,413

[1]Includes Georgia, New Mexico, Tennessee, and Vermont.
[2]Data do not add to total shown because of independent rounding.

Table 6.—Dimension sandstone sold or used by producers in the United States in 1987, by State

State	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Arkansas	10,541	132	$629
California	6	(1)	1
Indiana	3,800	49	225
New York	24,288	311	2,117
Ohio	28,597	391	2,336
Pennsylvania	24,003	308	922
Wisconsin	12	(1)	1
Other[2]	25,039	316	1,067
Total	116,286	[3]1,506	7,298

[1]Less than 1/2 unit.
[2]Includes Alabama, Arizona, Colorado, Georgia, Maryland, Michigan, Missouri, North Carolina, Oklahoma, and Tennessee.
[3]Data do not add to total shown because of independent rounding.

Table 7.—Dimension stone sold or used by producers in the United States in 1987, by use

Use	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Rough stone:			
Rough blocks for building and construction	240,329	3,072	$19,919
Irregular-shaped stone[1]	148,885	1,853	5,193
Flagging	2,700	27	165
Monumental	225,492	2,450	26,214
Other[2]	20,221	242	1,837
Dressed stone:			
Ashlars and partially squared pieces	210,034	2,611	45,729
Slabs and blocks for building and construction	52,671	672	18,101
Monumental	49,965	553	27,137
Curbing	129,294	1,532	23,339
Flagging	34,510	436	2,392
Flagging (slate)	9,086	--	1,785
Roofing slate	14,892	--	7,626
Structural and sanitary	5,636	--	3,200
Flooring slate	7,077	--	2,963
Other[3]	33,054	377	4,556
Total[4]	1,183,849	13,826	190,153

[1]Includes rubble.
[2]Includes unspecified uses.
[3]Includes a minor amount of slate used for billiard tabletops, miscellaneous, and unspecified uses.
[4]Data may not add to totals shown because of independent rounding.

Table 8.—Dimension granite sold or used in the United States in 1987, by use

Use	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Rough stone:			
Rough blocks for building and construction	85,052	961	$8,621
Irregular-shaped stone[1]	27,767	325	1,108
Flagging	2,700	27	165
Monumental	220,084	2,385	26,003
Other[2]	8,391	90	383
Dressed stone:			
Ashlars and partially squared pieces	106,132	1,231	25,275
Slabs and blocks for building and construction	11,308	134	1,405
Flagging	2,633	32	468
Monumental	37,813	425	20,311
Curbing	119,543	1,410	23,082
Other[3]	7,442	86	236
Total	629,365	7,106	[4]107,056

[1]Includes rubble.
[2]Includes rough stone used for flagging and unspecified uses.
[3]Includes flagging and unspecified uses.
[4]Data do not add to total shown because of independent rounding.

Table 9.—Dimension limestone sold or used by producers in the United States in 1987, by use

Use	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Rough stone:			
Rough blocks for building and construction	137,837	1,890	$9,964
Irregular-shaped stone[1]	70,082	880	1,266
Other[2]	10,623	143	1,300
Dressed stone:			
Ashlars and partially squared pieces	57,030	750	11,562
Slabs and blocks for building and construction	34,068	450	9,616
Monumental	3,061	22	264
Curbing	1,295	16	68
Flagging	12,735	168	434
Other[3]	3,112	42	493
Total	329,843	4,361	[4]34,968

[1]Includes rubble.
[2]Includes monumental and unspecified uses.
[3]Includes unspecified uses.
[4]Data do not add to total shown because of independent rounding.

Table 10.—Dimension marble sold or used by producers in the United States in 1987, by use

Use	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Rough stone:			
Rough blocks for building and construction	3,571	38	$734
Irregular shaped stone[1]	4,752	56	350
Dressed stone:			
Monumental[2]	16,048	188	19,330
Total	24,371	282	[3]20,413

[1]Includes rubble and a minor amount of stone used for monumental purposes.
[2]Includes dressed ashlars and partially squared pieces, slabs, blocks, a small amount used in flagging, and unspecified uses.
[3]Data do not add to total shown because of independent rounding.

Table 11.—Dimension sandstone sold or used by producers in the United States in 1987, by use

Use	Quantity (short tons)	Cubic feet (thousands)	Value (thousands)
Rough stone:			
Rough blocks for building and construction	11,705	156	$501
Irregular-shaped stone[1]	32,485	415	1,527
Other[2]	1,846	23	95
Dressed stone:			
Ashlars and partially squared pieces	36,869	486	1,637
Slabs and blocks for building and construction	621	8	27
Flagging	6,695	86	505
Other[3]	26,065	332	3,007
Total	116,286	1,506	[4]7,298

[1]Includes rubble
[2]Includes monumental and unspecified uses.
[3]Includes curbing and unspecified uses.
[4]Data do not add to total shown because of independent rounding.

Table 12.—Dimension slate sold or used by producers in the United States in 1987, by use

Use	Quantity (short tons)	Value (thousands)
Flagging (slate)	9,086	1,785
Roofing (slate)	14,892	7,626
Structural and sanitary	5,636	3,200
Flooring (slate)	7,077	2,963
Other[1]	2,990	873
Total	39,681	[2]16,446

[1]Includes a minor amount of slate used for billiard tabletops, blackboards, and unspecified uses.
[2]Data do not add to total shown because of independent rounding.

PRICES

The average price for dimension stone rose to $161 per ton, up 8% from $149 in 1986.

FOREIGN TRADE

Exports.—Exports of dimension stone, about one-half of which was granite, increased 40% in value.

Imports.—Imports for consumption of dimension stone increased 16% in value to $439 million, mostly because of an increase in imports of polished slabs of marble, partly offset by a decrease in imports of dressed granite. Imports of polished marble slabs, mostly from Italy, increased 45% to

$179 million. Imports of dressed granite decreased 10%. On a value basis, marble accounted for 54% of imports, followed by granite, 33%; travertine, 6%; and slate, 4%.

Table 13.—U.S. exports of dimension stone, by type

(Thousand short tons and thousand dollars unless otherwise specified)

Type	1986		1987		Major destination in 1987 (percent[1])
	Quantity	Value	Quantity	Value	
Granite articles	NA	1,530	NA	2,608	Canada 44%.
Granite, rough	53.3	6,046	54.2	7,800	Japan 58%.
Limestone, dressed, for building or monumental	25.9	113	2.4	257	United Kingdom 24%.
Limestone articles	4.8	178	18.0	1,000	Italy 80%.
Marble, breccia, and onyx, rough or squared	14.2	290	20.9	514	Canada 63%.
Marble, breccia, and onyx articles	NA	1,727	NA	2,694	Japan 24%.
Slate building articles	NA	118	NA	213	Canada 49%.
Slate building articles, other	NA	967	NA	905	Canada 25%.
Stone, rough, for building or monumental	15.6	1,735	19.0	2,280	Canada 48%.
Stone, other, including alabaster or jet	NA	1,919	NA	2,199	Canada 60%.
Total	NA	14,622	NA	20,470	

NA Not available.
[1]By value.

Source: Bureau of the Census.

Table 14.—U.S. imports for consumption of dimension granite, by country

(Thousand cubic feet and thousand dollars)

Country	Rough[1]		Dressed[1]		Other n.s.p.f. undecorated[2] (value)
	Quantity	Value	Quantity	Value	
1985	3,020	6,097	7,928	103,680	11,064
1986:					
Brazil	167	166	253	3,603	459
Canada	1,078	3,757	199	12,365	2,486
India	14	287	268	1,290	16
Italy	665	218	7,596	104,467	4,052
Japan	[3]	10	10	167	363
Portugal	--	--	341	1,773	5
Saudi Arabia	[3]	25	7	373	--
South Africa, Republic of	382	1,695	[3]	19	--
Spain	13	57	646	10,985	50
Other	377	492	320	7,143	1,211
Total[4]	2,699	6,707	9,635	142,185	8,642
1987:					
Brazil	575	152	315	3,294	199
Canada	5,329	5,125	249	12,621	507
India	9	165	120	2,446	26
Italy	37	587	4,626	89,655	4,606
Japan	--	--	15	188	64
Portugal	593	1,224	20	977	54
Saudi Arabia	1	11	19	303	--
South Africa, Republic of	80	2,435	1	44	--
Spain	1	3	355	10,527	76
Other	708	938	342	7,540	546
Total[4]	7,333	10,641	6,063	127,594	6,078

[1]Excludes unmanufactured, nonmonumental granite.
[2]Quantity not reported. Excludes granite n.s.p.f. decorated.
[3]Less than 1/2 unit.
[4]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 15.—U.S. imports for consumption of major categories of dimension marble, travertine, and other calcareous stones, by country

Country	Marble, breccia, or onyx, polished slabs		Marble, breccia, or onyx, other n.s.p.f.[1 2]	Travertine dressed[3]	
	Quantity (thousand square feet)	Value (thousands)	Value (thousands)	Quantity (short tons)	Value (thousands)
1985	56,137	$88,579	$39,521	180,311	$18,654
1986:					
France	976	2,975	671	23	20
Germany, Federal Republic of	362	493	832	13	9
Greece	2,883	6,124	535	15	12
Italy	51,184	83,785	29,810	172,430	15,066
Mexico	1,176	2,032	2,719	425	231
Pakistan	71	103	523	--	--
Philippines	198	342	102	--	--
Portugal	3,049	5,936	961	43	14
Spain	10,832	15,620	2,824	739	69
Taiwan	1,665	2,749	6,367	--	--
Other	1,672	3,479	2,383	124	75
Total	74,069	123,637	47,728	173,814	15,496
1987:					
France	1,307	6,657	464	59	23
Germany, Federal Republic of	320	597	866	--	--
Greece	3,569	9,155	1,042	55	66
Italy	53,338	120,692	29,686	104,508	14,285
Mexico	1,894	3,201	2,567	776	364
Pakistan	26	8	528	--	--
Philippines	365	763	315	--	--
Portugal	3,240	7,513	1,278	--	--
Spain	15,925	20,161	2,868	1,437	127
Taiwan	4,382	4,813	9,407	--	--
Other	2,279	5,469	4,088	165	261
Total[4]	86,645	179,030	53,109	107,000	15,128

[1]Excludes special kinds of rough marble, breccia, or onyx.
[2]Quantity not reported.
[3]Suitable for use as monumental, paving, or building stone. Excludes travertine articles.
[4]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

Table 16.—U.S. imports for consumption of other dimension stone, by type

Type		1986		1987		Major source in 1987 (percent[1])
		Quantity	Value (thousands)	Quantity	Value (thousands)	
Granite, n.s.p.f., decorated		--	$933	--	$1,344	Italy 57%.
Limestone, dressed, hewn	short tons	34,553	2,288	25,545	6,184	France 63%.
Marble and breccia, rough	cubic feet	87,002	515	86,538	840	Italy 61%.
Marble, breccia, onyx, slab and tiles, unpolished	square feet	914,748	2,593	1,441,111	4,428	Italy 50%.
Slate, roofing	do.	2,152,986	927	4,053,425	1,863	Spain 51%.
Slate, other, n.s.p.f.		--	8,876	--	13,404	Italy 63%.
Travertine articles, undecorated		--	6,222	--	8,250	Italy 94%.
Travertine articles, decorated		--	1,532	--	1,573	Italy 92%.
Stone, unmanufactured	short tons	30,940	966	5,765	658	Mexico 50%.
Stone, dressed, building	do.	2,483	825	24,589	2,094	Mexico 35%.
Stone, other n.s.p.f., undecorated		--	2,034	--	2,574	Italy 16%.
Stone, other n.s.p.f., decorated		--	3,723	--	4,486	Mexico 21%.

[1]By value.

Source: Bureau of the Census.

WORLD REVIEW

Dimension stone is quarried in most countries of the world. As usual, Italy produced about one-half of the world's total. Other significant producers were Brazil, Finland, India, Norway, Portugal, Spain, Sweden, Turkey, and the United States.

Bulgaria.—Bulgaria, a sizable producer of dimension stone, usually produces about 240,000 tons of rough block, of which marble comprises 120,000 tons. Significant amounts of other kinds of stone are also produced. Exports to destinations outside Eastern Europe are quite small, usually averaging 1,000 to 2,000 tons per year, and almost all marble.

The first description of the dimension stone industry in Bulgaria in a long time appeared this year. The deposits are scattered fairly evenly throughout the country except for the north. Domestic use of stone has increased dramatically in the last few decades. The quarries used a mix of modern equipment, such as chain saws, and older equipment, such as helicoidal wire saws. A number of finishing plants were situated around the country, most of which used Italian, West German, and Bulgarian equipment. Most marble slab produced is 2 centimeters thick and much of the marble tile produced is 1 centimeter thick. The marble produced is almost all gray or white with various colored streaks or marks. Travertine and breccia also are produced.[4]

Germany, Federal Republic of.—According to the most recent estimates of the Government of the Federal Republic of Germany, dimension stone production is usually 1.1 to 1.3 million tons per year, with 70% to 75% of the total coming from Bavaria. This number includes many firms with fewer than 10 employees, companies usually that are missed by the statistical surveys. Bavarian production is mostly of granite, marble, and Solenhofen limestone. Production of rough blocks in 1982 was estimated at a minimum of 104,600 tons of marble and 20,600 tons of granite.

The industry uses some innovative extraction techniques. For Jura marble, large pieces of stone are divided by drilling a series of holes to which an automatic wedger is applied. Resembling a jackhammer in appearance, the hydraulic device drives a wedge down between the feather parts of the machine, forcing the stone apart. Slate is cut from the face with a self-propelled, circular, diamond saw machine along a rectangular grid. Blows from a self-propelled hydraulic hammer split off the material from the face.

The market for roofing slate has increased greatly in the last decade, mostly at the expense of asbestos tiles once asbestos-related health problems became known. Domestic production of roofing slate grew from around 16,500 tons in 1975 to 55,000 tons in 1986.

The major West German marble is the light yellow Jura marble, of which about $90 million is produced each year. The marble is quarried mostly in Bavaria in conjunction with the Solenhofen limestone. It is usually used in polished form as window and door sills and flooring. Exports constitute about 25% of production, almost all destined to other Western European nations.

Japan.—Production of dimension granite in 1987 was estimated to be 500,000 tons from about 1,000 quarries. Production of dimension marble was about 300 tons in 1987. The granite, almost all standard gray, was quarried in Aichi, Ehime, Fukushima, Ibaragi, and Yamaguchi Prefectures.

The principal use of dimension granite is for monuments. Typical monumental products include grave plot stones, stone lanterns, torji gates, and cemetery fences.

Customers are conservative and buy gray granite monuments exclusively in most of Japan although some black granite is used north of Tokyo. Based on industry sources and a small sample of plants, the more a plant is involved in producing monuments the more likely it is to be labor intensive, have a small staff and use older types of equipment. No plants are known to use robots.

The next largest uses of dimension granite stone are for buildings, curbing, embankments, and paving. Almost all tile is imported. Customers prefer gray, pink, black, and red granite for building purposes, plus minor amounts of other colors. The granite is sold usually as 2.5-centimeter slabs, sometimes as 3-centimeter slabs. A plant producing primarily architectural products is likely to be less labor intensive, larger, and have more modern equipment such as automatic polishers.

Other stones are used in much smaller volumes. Marble is almost exclusively used in buildings; virtually none goes to monuments. Customers prefer colored, multicol-

ored, and veined marbles over white. Growth in marble use has tended to be offset by the use of increasingly thinner marble. Relatively small amounts of slate are used, including roofing slate, but the use of it seems to be increasing rapidly. However, roofing slate encounters severe competition from traditional curved gray tile, since tile lasts nearly as long, costs the same, and is more culturally acceptable to the Japanese.

Japanese culture strongly influences the purchases of dimension stone. Dimension stone used outdoors must be in harmony with the environment and become part of an overall design; this means that requests for color and pattern are very specific. Stone required for the interior or exterior of buildings must be of a very uniform color and pattern, as close to matching as possible, without any surficial cracks or scars. This requirement sometimes extends beyond the limits imposed by the variability of a natural product. There may be other stringent requirements, such as low water absorption or tight physical and chemical standards for stone in outdoor use. This is particularly true for granite monuments.

Korea, Republic of.—Dong-in Stone Industrial Co. Ltd. scheduled the opening of a huge new granite processing and finishing complex at Chongju City. The complex will cost about $20 million and employ 600 people, including those working in its associated diamond tool and machinery plant. It ultimately will include 38 gang saws, each producing 20,000 square feet of granite slab per month.

U.S.S.R.—The Soviet Union is a sizable producer of dimension stone but not as large as might be expected from its immense land area. Production totaled about 350,000 tons, mostly of granite but with significant amounts of other kinds produced. Exports, composed of mostly granite, to destinations other than its allied countries are quite small, usually averaging 5,000 to 10,000 tons per year.

A description of the Soviet dimension stone industry, with an emphasis on its products, appeared in a Western stone publication this year, the first such description in many years. The more important or better known stones described included the reddish-brown granite with coarse ovoid feldspar grains from Kuzrechenskoye, the black gabbro-norite (black granite) with blue or rose plagioclase from Chernaya Salma, the deep crimson quartzite from Petrozavodsk that was used to make Napoleon's tomb in Paris, and the black coarse-grained labradorite from Golovino, Zhitomir region. Many techniques employed in other countries are not yet in use in the U.S.S.R. For example, the installation of diamond wire saws in marble quarries is just beginning, as is the automation of saws and the introduction of diamond tools in the finishing plants.[3]

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[1]Physical scientist, Branch of Industrial Minerals.
[2]Stoev, S. The Decorative Stone Industry in Bulgaria. Stone Industries, v. 22, No. 5, June 1987, pp. 27-30.
[3]Oskolkov, V. A. Growth of U.S.S.R. Stone Industry. Stone Ind., v. 22, No. 1, Jan.-Feb. 1987, pp. 22-24.

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